Operationalizing Off-task Sociability of Asynchronous Computer Supported Collaborative Learning

Babak Abedin, School of Information Systems, Technology and Management, Australian School of Busioness, University of New South Wales, Sydney, Australia, B.abedin@unsw.edu.au

Farhad Daneshgar, School of Information Systems, Technology and Management, Australian School of Busioness, University of New South Wales, Sydney, Australia, F.daneshgar@unsw.edu.au

Abstract

Many previous studies have emphasized the role of the sociability of the computer supported collaborative learning (CSCL) environments on learning achievements. Also, recent studies have reported that other than on-task interaction, students have considerable off-task interactions in CSCL environments. Yet, more studies are needed to clarify the off-task aspect of social interactions in CSCL and sociability of the environment. This paper attempts to investigate and operationalize sociability of CSCL environments from off-task point of view in order to further clarify this aspect of CSCL. It first reviews previous sociability questionnaires and instruments and then proposes a list of measure to represent and operationalize off-task sociability of CSCL. The proposed list of measures is then validated through experts' judges and finally implications are discussed.

1. Introduction

Preece (2001) defines an online community as "any virtual social space where people come together to get and give information or support, to learn or to find company". This online community "can be local, national, international, small or large". The invention of the World Wide Web made different communities to be easily emerged and developed. Among different online communities, learning and educational communities have rapidly developed and could attract surprising numbers of learners and providers (Harasim, 2000). (Francescato et al., 2006) mention that there are two online learning modes; one mode focuses on individual's interactions with computers, the other encompass individual's interactions with other participants in order to facilitate learning through collaboration.

This study investigates the second mode, also known as Computer Supported Collaborative Learning (CSCL), which provides various benefits such as overcoming physical and time limitations, providing an effective virtual space for students and lecturers to discuss educational problems, managing documents and materials, students' sharing and exchanging knowledge with others (Janssen et al, 2006; Redmond & Lock, 2006). (Brandon and Hollingshead, 1999) identify three main building blocks for CSCL, which are "communication' and 'collaboration' of learners in a 'social context'. In addition, this way of learning can happen in two forms: asynchronous or/and synchronous. While, in the former involved parties are logged on at different times, in the latter learners are logged on at the same time and exchange messages in the real time (Naidu and Ja¨rvela, 2006).

Due to the CSCL advantages, more web-based applications have been developed in recent years, in which developers intended to add more features to software tools to facilitate access, share and use of educational information (REF). However, researchers have started to focus on social and human side of CSCL, as Kollock (1996, 1998) states "the key challenges the Internet community will face in the future are not simply technological but also sociological". He proposed that designers must also consider individuals' social needs in developing such software tools and online communities (Bogdan and Pargman, 2002, Farnham et al., 2001).

This paper attempts to operationalize off-task sociability of CSCL. It first reviews the literature of sociability in general, and sociability of computer supported collaborative learning environments, in particular. Then the paper goes through findings of previous studies in distinguishing on-task and off-task social aspect of CSCL. According to the previous sociability questionnaire and instruments, a list of items is created and proposed which attempts to represent off-task sociability of CSCL.

2 Sociability of CSCL

The term sociability is a widely used term in the literatures of sociology and psychology where it is considered as a 'factor' and 'trait' of an environment or a person. In this context, sociability, as a personal factor, is defined as a person's desire to affiliate with others, which implies people's interest (and need) to interact with others and establish social relationships (Bruch et al., 1999, Cheek and Buss, 1981). The concept has also been applied to the traditional classroom environments. (Beach, 1980) states that sociability, as a personal factor, should be considered for effective learning and teaching methods and her findings suggest that more sociable students achieve higher levels of interactions than less sociable students.

However, the term is almost new to the CSCL studies and still there is not an agreed upon definition for it. (Kreijns et al., 2002, Kirschner et al., 2004) define CSCL sociability as the 'medium factor' which is the extent to which CSCL is able to establish a sound social space where social interactions are encouraged. (Laffey et al., 2006)

consider sociability as the ability of CSCL systems to provide an environment where individuals can interact socially. The authors note "to the extent that the technology affords a socially meaningful and satisfying interaction, the information system will motivate and sustain social activity and social benefits". (Preece, 2000) considers sociability to those social policies and technical structures that support the community's shared purpose and social interactions among group members. She identifies three key components of sociability of online communities as following:

- *Purpose.* A community's shared focus on an interest, need, information, service, or support that provides a reason for individual members to belong to the community
- *People.* The people who interact with each other in the community and who have individual, social and organization needs.
- *Policies.* The language and protocols that guide people's interactions and contribute to the development of folklore and rituals that bring a sense of history and accepted social norms.

Recently more researchers have investigated sociability of computer mediated collaborative learning environments (Wright et al., 2005, Clark, 2003, Bogdan and Pargman, 2002, Laffey et al., 2006). (Preece, 2001) proposes that good software in supporting human interactions in online communities has got two main components. These are 'usability' and 'sociability'. While the first one is more technical in software design and deals with the ease of user navigation, the sociability component includes features that deal with people, community purposes, rules and policies.

Some researchers believe that CSCL sociability is affected by the properties of the environment, which is defined as social affordances (Kreijns et al., 2002, Ponti and Ryberg, 2004). According to these researchers, online learning affordances come from properties of the media and virtual environment, whereas group awareness is recognized as one of the main properties in online communities. The above authors then develop CSCL modules that facilitate group awareness among learners in order to improve sociability of the online classroom. (Soller, 2001) and (Soller et al., 1998) emphasize individuals' participation and social considerations in effective online collaborative learning and introduce Intelligent Collaborative Learning Model to support social interactions in this context. (Barab et al., 2001) develop an Inquiry Learning Forum (ILF) which is a socio-technical web-based professional development tool designed to support a community of teachers creating, sharing, and improving inquiry-based on-task practices. The main objective of their sociable tool is enhancing social environment of the class with three major sociability themes: (1) The need to build structures that supported group collaboration and work, (2) The need to provide structured tasks (goal sets) for engaging with the E-ILF and ILF community, and (3) The need to provide more visible connections to people, conversations, and artefacts of interest to each ILF member.

3 Off-task Social Interactions

Current studies in social interactions in CSCL indicate that by simply putting students in a computer supported environment with several technological features does not lead to productive collaboration and social interactions (Hakkinen, 2004, Kreijns et al., 2003). Rather, more investigation is necessary to analyse individuals' online activities in order to identify different categories of social interactions and students' social needs. This, in turn, can improve CSCL systems to facilitate provision of more sociable environments. McInnerney and Roberts (2004) mention that much thoughts need to be given to analysing students' social needs in online classes and to enhance communication so that the online environment fulfils the human desire for social interaction.

Analysis of content of students' messages in CSCL clarifies that there are two sort of social interactions: on-task and off-task (Dewiyanti et al., 2007, Lipponen et al., 2003). Where the former is on-task and learning-related message exchanges, the latter is off-task interactions such as chit-chats, greetings, and telling-offs. Figure 1 depicts the continuum of students' social interactions in learning environments. However, as Kreijins et al. (2002) notice, there is not any fixed line between on-task and off-task interactions and students working on tasks easily and frequently switch to a non task-context for a short while and then back to the task context.
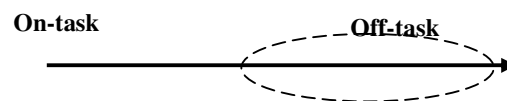

Figure 1: Continuum of students' social interactions in CSCL

Although, so far, less attention had been paid to off-task social interactions, more studies have recently reported the essence of considering and investigating those interactions in CSCL. Kreijns et al. (2003) raise the issue of neglecting off-task dimension of social interaction as one of current pitfalls of CSCL effectiveness and criticizes developers and educators, who assume that such interactions will automatically happen in online environments. In his study, Wegerif (1998) evaluates asynchronous learning networks (ALN) and argues that previous researchers have overlooked on educational and on-task dimension of ALNs, while evidences show that off-task social dimension effect learning outcomes and must be considered in the design and development of computer-mediated courses. He mentions that without considering sense of community and off-task social dimension, students

are "likely to be anxious, defensive and unwilling to take the risks involved in learning". Following table summarizes findings of some of previous researches in Computer Mediated Communication (CMC) and CSCL environments, regarding off-task social interactions.

Table 1: Previous studies which have addressed off-task social interactions in CMC and CSCL

Author(s)	Findings
(Pena and Hancock, 2006)	Existence of more social non-task messages in CMC than on-task messages More positive than negative social messages
(Kreijns et al., 2003)	Pitfalls for social interactions in CSCL environments: 1) taking for granted that participants will socially interact simply because the environment makes it possible. 2) neglecting the social (psychological) dimension of the desired social interaction.
(Stodel et al., 2006)	In Comparison with face-to-face, students felt social factors that facilitate their interactions and sense of community are missed in the online environment
(Wegerif, 1998)	Studying the role of social dimension in CSCL effectiveness: Students' success depends on the extent they are able to cross from the threshold of feeling outsider to feeling insider
Jones & Issroff (2005)	Important issues such as 'motivation', 'feeling' and 'attitude' often have been excluded, cause they are viewed problematic in CSCL studies
(Potter and Balthazard, 2002)	Interaction styles of virtual teams affect both performance and process outcomes in ways that are directionally consistent with those exhibited by conventional face-to-face teams.
(McInnerney and Roberts, 2004)	Sense of isolation is ignored by most of educators A proper appreciation of the learners' social context [on-task and off-task] is needed for successful online collaborative learning

According to table 1, findings of previous studies confirm both presence and significance of off-task social interactions in computer supported learning communities. In addition, it should be noted that other than off-task social issues, affective and emotional issues are also known as 'off-task' interactions in CSCL (Caplan and Turner, 2007). However, this study does not include emotional and peoples' internal feelings and it aims to address off-task social and interaction-between-people dimension of CSCL.

4 The List of Items of Off-Task Sociability of CSCL

What are the measures for defining off-task sociability CSCL? Some studies have already investigated aspects of social space for online communities and have identified certain measures but none of them have explicitly distinguished between on-task and off-task attributes. In this section, previous studies that have indicated measures or factors of sociable CSCL environments are reviewed. This review constitutes foundation for a proposed framework for identifying factors and measure of off-task social dimension of CSCL.

Current studies have generally investigated the atmosphere and environment of online communities in order to assess the level of perceived sociability by students and communicators. Table 2 summarizes instruments that aimed to measure sociability or social atmosphere of online collaborative learning environment.

Table 2: Review of instruments which measure online communities' sociability

Instrument Name	Purpose
Social Ability Instrument(Laffey et al., 2006)	Measuring the construct of 'social ability' in online education
Self-Reported Sociability Scale(Kreijns et al., 2004)	Measuring sociability of online classes based on social presence theory
Intimacy of Social Presence(Gunawardena, 1995)	Understanding student reactions on a range of feelings toward the medium of CMC
Social Presence Questionnaire(Lin, 2004)	Assessing social presence for computer support for cooperative systems
Group Atmosphere Scale(Fiedler, 1967) &(Fiedler, 1962)	assessing the atmosphere in a group as perceived by the group
(Finn, 1999)	Analyzing and categorizing messages in an online social support group

For the development of the proposed framework the following three steps were taken: First, all measures

and factors for each instrument were collected and put together in a table. In the second step, items of each instrument were compared to those of other instruments and in cases that one factor was addressed in more than one instrument, only one of them was considered and others were deleted from the list. As a result of this comparison process, we came up with a list of unique items in all the categories combined. In the third step, each author separately analysed each measure to determine which ones were on-task attribute and were related to learning activities and which ones were off-task. This judgement was based on the original definition and explanation provided for each item in the relevant paper and then an agreed set of attributes were produced.

The final framework included sixteen measures. The authors then reassessed each measure based on its description and application in the original study and further categorized those items in eight groups, or factors. This grouping process was conducted in two steps. First, each author of the paper independently generated a factors list. Then, reading the original papers and reassessing application of each item in different studies, the two different factor lists were then compared and a final list of groups (factors) and measures for each factor was created (see table 3).

Table 3: A Conceptual Framework for Characterising off-task social measures and factors for CSCL Environments

Group (Factor)	Measure(s)
Loneliness	1- Feeling alone 2- Working with others/alone
Impression exchange	1- Expression of feelings 2- Getting impression of Others
Altruism	1- Respect in relations 2- Reliability in relations 3- Findings support/help
Conventionality	1- Feeling calm & less anxious 2- Warmness of environment
Appeal	1- Appealing/frustrating 2- stimulating/dull 3- interesting/boring
Interactivity	1- interactive-non interactive 2- Immediate
Chit chatting	1- Chit chatting
Friend making	1- Friend making

Table 3 shows factors and measures that represent off-task sociability of computer supported collaborative learning environments and provides a brief description for each factor. The framework consists of seven factors: Impression exchange, Altruism, Conventionality, Appeal, Interactivity, Chit chatting and Friend making. Each factor represents one off-task social need of learners, which is detailed and clarified by one or more measures.

One distinct characteristic of this framework is its ability to distinguish between off-task and on-task factors, and to be able to clarify each factor through one or more measures. These factors also represent high-level user requirements foran CSCL technology/system related to the off-task needs of learners, that will lead to more students' participation in online activities and consequently, enhanced learning outcomes.

Therefore, the framework can be used in future researches to investigate social dimension of CSCL and also be used for developers of e-learning system to explicitly cover off-task needs of students in their design for virtual learning environments.

5 Validation of the Study

Straub et al. (2004) mention that assessing content validity of theoretical works in Information Systems is highly recommended. They argue that the essential question posed by this validity is whether the instrumentation is wisely developed 'so that the measures can capture the essence of the construct', which can be established through review of literature and experts opinions or panels. Authors have applied utmost care to ensure that the proposed list of measures benefits from all major relevant previous studies in the domains of CSCL and CMC. Potentially, this will increase objectivity and the rationale on which the framework is based on, which in turn will enable development of instruments that both measures and captures the essence of the construct. Furthermore, during the development of the proposed list, extensive dialogues were conducted with experts from the fields eLearning, education, CSCL, CSCW, and Knowledge Management within a large university network, in order to further validate semantic and quality attributes of the proposed framework. Two internal presentations were given to fairly large groups of PhD students and their supervisors, and their comments and advice were also carefully considered.

In addition to content validity, Wilson (1997) and Anderson (2003) (cited in (Anderson, 2003) argue that a good theoretical products in educational context performs three functions: First, it helps researchers to envision new world. The proposed product in this paper encompasses those students' interactions that not only encourage students to have more effective and social interactions, but also directly and/or indirectly can positively affect their learning outcomes. Second, a good theoretical product helps us create things. As more courses and degrees are going to be offered through the Internet, more effective software tools and CSCL systems are needed to provide better and more enjoyable learning environments for participants (Ibid). The proposed measure list represents conceptual foundation of an architectural view of a CSCL technology that satisfies off-task social needs of learners. The third characteristic then is to exercise utmost honesty. Authors of this study made sure that the required literature was reviewed consistently and

not selectively, that during the development process no particular inner tendency or inherent prejudice towards a specific research perspective was affecting the selection of the research model, and that all the incremental findings were reported o some interest groups of researchers within the research network of a large Australian university.

6 Conclusion

This paper reviewed previous studies in sociability of computer supported collaborative learning environment and recognized that while current literatures emphasized the importance of better sociable environments and also recent findings distinguish between on-task and off-task social interactions, few researches have explicitly investigated the role of the former in effectiveness of the computer based collaborative learning. This study addressed this issue by developing and validating a list of items which proposes factors and measures for off-task sociability CSCL environments. The proposed list includes sixteen measures which based on similarity of definitions is categorized in eight groups. One distinct characteristic of the proposed is recognition of the off-task social measures, which can potentially inform future development of e-learning software systems for improving effectiveness and performance of the CSCL environments.

Reference

Anderson, T. Getting the Mix Right Again: An updated and theoretical rationale for interaction. International Review of Research in Open and Distance Learning, 4, 2003, 1-14.

Barab, S. A., Barnett, M. & Squire, K. Developing an Empirical Account of a Community of Practice: Characterizing the Essential Tensions. The Journal of Learning Sciences, 11, 2002, 489-542.

Barab, S. A., Makinster, J. G., Moore, J. A. & Cunningham, D. J. Designing and Building an On-line Community: The Struggle to Support Sociability in the Inquiry Learning Forum. Educational Technology, Research and Development, 49, 2001, 71-96.

Beach, L. R. Sociability and academic achievement in various types of learning situations. journal of educational psychology, 51, 1980, 208-212.

Bogdan, C. & Pargman, T. C. Reconsidering Support for the Members of Specialized Online Communities. the 34th Congress of the Nordic Ergonomics Society. Linkopings Universitet, NES. 2002

Brandon, D. P. & Hollingshead, A. B. Collaborative learning and computer supported groups. Communication Education, 48, 1999.

Bruch, M. A., Rivet, K. M., Heimberg, R. G., Hunt, A. & Mcintosh, B. Shyness and sociotropy: Additive and Interactive Relations in Predicting Interpersonal Concerns. Journal of personality 67, 1999.

Cheek, J. M. & Buss, A. H. Shyness and Sociability. Journal of Personality and Social Psychology, 41, 1981, 330-339.

Clark, T. Disadvantages of Collaborative Online Discussion and the Advantages of Sociability, Fun and Cliques for Online Learning. the IFIP Working Groups 3.1 and 3.3 Working Conference: ICT and the Teacher of the Future. Melbourne, Australia, 2003.

Collazos, C. A., Guerrero, L. A., Pino, J. A. & Ochoa, S. F. Collaborative Scenarios to Promote Positive Interdependence among Group Members. IN FAVELA, J. & DECOUCHANT, D. (Eds.) LNCS 2806. Berlin, Heidelberg, Springer-Verlag, 2003.

Daradoumisa, T., Nez-Mone´sb, A. M. & Xhafa, F. A layered framework for evaluating on-line collaborative learning interactions. International Journal of Human-Computer Studies, 64, 2006, 622-635.

Deqiyanti, S., Brand-Gruwel, S., Jocjems, W. & Broers, N. J. Students experiences with collaborative learning in asynchronous Computer-Supported Collaborative Learning environments. Computers in Human Behavior, 23, 2007, 496-514.

Fahreus, E. R. Distance Education Students Moving Towards Collaborative Learning - A Field Study of Australian Distance Education Students and Systems. Educational Technology & Society, 7, 2004, 129-140.

Farnham, S., Zamer, M. & CHENG, L. Supporting Sociability in a Shared Browser. Interact Conference. Tokyo, Japan, 2001.

Fiedler, F. E. Leader attitudes, group climate,and group creativity. Journal of Abnormal and Social Psychology, 65, 1962, 308-318.

Fiedler, F. E. A theory of leadership effectiveness., New York, McGraw-Hill, 1967.

Finegold, A. R. D. & Cooke, L. Exploring the attitudes, experiences and dynamics of interaction in online groups. Internet and Higher Education, 9, 2006, 201-215.

Finn, J. An exploration of helping processes in an online self-help group focusing on issues of disability. Health & Social Work;, 24, 1999, 220-232.

Francescato, D., Porcelli, R., Mebane, M., Cuddetta, M., Klobas, J. & Renzi, P. Evaluation of the efficacy of collaborative learning in face-to-face and computer-supported university contexts. Computers in Human Behavior, 22, 2006, 163-176.

Girgensohn, A. & Lee, A. Making web sites be places for social interaction. CSCW'02, 2002.

Gunawardena, C. N. (1995) Social Presence Theory and Implications for Interaction and Collaborative Learning in Computer Conference. International Journal of Educational Telecommunications, 1, 147-166.

Hakkinen, P. (2004) What Makes Learning and Understanding in Virtual Teams So Difficult? CyberPsychology & behavior, 7, 201-208.

Harasim, L. M. (2000) Shift happens: online education as a new paradigm in learning. The Internet and Higher Education, 3, 41-61.

Hrastinski, S. (2006) Introducing an informal synchronous medium in a distance learning course: How is participation affected? Internet and Higher Education, 9, 117-131.

Hron, A. & Friedrich, H. F. (2003) A review of web-based collaborative learning: factors beyond technology. Journal of Computer Assisted Learning, 19, 70-79.

Janssen, J., Erkens, G., Kanselaar, G. & Jaspers, J. (2006) Visualization of participation: Does it contribute to successful computer-supported collaborative learning? Journal of Computers & Education, (under publication).

Jehng, J. J. (1997) The psycho-social processes and cognitive effects of peer-based collaborative interactions with computers. Journal of Educational Computing Research, 17, 19-46.

Kirschner, P. A., Strijbos, J.-W., Kreijns, K. & Beers, P. J. (2004) Designing Electronic Collaborative Learning Environments. Journal of educational technology research & development, 52, 47-66.

Kreijns, K., Kirschner, P. A. & Jochems, W. (2002) The Sociability of Computer-Supported Collaborative Learning Environments. Educational Technology & Society, 5, 8-23.

Kreijns, K., Kirschner, P. A. & Jochems, W. (2003) Identifying the pitfalls for social interaction in computer-supported collaborative learning environments: a review of the research. Computers in Human Behavior, 19, 335-353.

Kreijns, K., Kirschner, P. A., Jochems, W. & Buuren, V. H. (2004) Determining Sociability, Social Space, and Social Presence in (A)synchronous Collaborative Groups. CyberPsychology & behavior, 7, 155-172.

Lafeey, J., Lin, G. Y. & Lin, Y. (2006) Assessing Social Ability in Online Learning Environments. Journal of Interactive Learning Research, 17, 163-177.

Lam, W. (2004) Encouraging Online Participation. Journal of Information Systems Education, 15, 345.

Lin, G.-Y. (2004) Social Presence Questionnaire of Online Collaborative Learning: Development and Validity. Association for Educational Communications and Technology.

Lipponen, L., Rahikainen, M., Lallimo, J. & Hakkarainen, K. (2003) Patterns of participation and discourse in elementary students' computer-supported collaborative learning. Learning and Instruction, 13.

Mcinnerney, J. M. & Roberts, T. S. Online Learning: Social Interaction and the Creation of a Sense of Community. Educational Technology & Society, 7, 2004, 73-81.

Mcneil, S. G., Robin, B. R. & Miller, R. M. Facilitating interaction, communication and collaboration in online courses. Computers & Geosciences, 26, 2000, 699-708.

NAIDU, S. & JA¨RVELA, S. Analyzing CMC content for what? Computers & Education, 46, 2006, 96–103.

NICOL, D. J., MINTY, I. & SINCLAIR, C. The Social Dimensions of Online Learning. Innovations in Education and Teaching International, 40, 2003, 270.

Pena, J. & Hancock, J. T. An Analysis of Socioemotional and Task Communication in Online Multiplayer Video Games. Communication Education, 23, 2006, 92-109.

Picciano, A. G. Beyond Student Perceptions: Issues Of Interaction, Presence, And Performance In An Online Course. Journal of asynchronous learning networks, 6, 2002, 21-41.

Ponti, M. & Ryberg T. Rethinking virtual space as a place for sociability: Theory and design implications. IN BANKS, S., Goodyear, P., Hodgson, V., Jones, C., Lally, V., Mcconnell, D. & Steeples, C. (Eds.) the Fourth International Conference on Networked Learning 2004. Lancaster, Lancaster University and University of Sheffield. 2004.

Potter, R. E. & Balthazard, P. A. Virtual teaminteraction styles: assessment and effects. International Journal of Human-Computer Studies, 56, 2002, 423-443.

Prceece J. Online Communities: Designing Usability, Supporting Sociability, Chichester, England, John Wiley & Sons. 2000

Preece, J. Sociability and usability in online communities: determining and measuring success. Behaviour and Information Technology, 20, 2001, 347-356.

Soller, A., Goodman, B., Linton, F. & Gaimari, R. Promoting effective peer interaction in an intelligent collaborative learning environment. the Fourth International Conference on Intelligent Tutoring Systems (ITS '98). San Antonio, TX. 1998.

Soller, A. L. Supporting Social Interaction in an Intelligent Collaborative Learning System. International Journal of Artificial Intelligence in Education, 12. 2001

Stacy, E. Social Presence Online: Networking Learners at a Distance. Education and Information Technologies, 7, 2002, 287-294.

Stodel, E. J., Thompson, T. L. & Macdonald, C. J. Learners' Perspectives on What is Missing from Online Learning: Interpretations through the Community of Inquiry Framework. International Review of Research in Open and Distance Learning, 7, 2006.

Straub, D., Boudreau, M.-C. & Gefen, D. Validation Guidlines For IS Positivist Research. Communications of the Association for Information Systems, 13, 2004, 380-427.

Tu, C.-H. On-line learning migration: fromsocial learning theory to social presence theory in a CMC environment. Journal of Network and Computer Applications, 23, 2000, 27-37.

Vygotsky, L. S. Mind in society: The development of higher psychological processes, Cambridge, MA, Harvard University Press. 1978.

Wegerif, R. The Social Dimension of synchronous Learning Networks. Journal of asynchronous learning networks, 2. 1998

Wilson, B. Thoughts on theory in educational technology. Educational Technology, 37, 1997, 22-26.

Wright, N., Varey, A. & Chesney, T. An investigation of sociability measurements in online communities. International Journal of Web Based Communities, 1, 2005, 400-412.